Registered Sweetpotato Commercial Seed Producers (CSP) in Tanzania (Credit: S. Rajendran)

Building sustainable business model(s) for sweetpotato Commercial Seed Producers in Tanzania and Uganda

Highlights

- The rapid seed system assessment in Uganda and Tanzania identified three major market segments based on the type of customers who purchase sweetpotato improved seed[1] for different uses. These are i. Institutional buyers, ii. Sweetpotato root producers, and iii. Trained commercial sweetpotato seed producers. The size of market segments differs by variety and location.
- The key informant interviews with institutional buyers identified sub-categories based on distinct needs and wants. They are segmented into two homogenous groups of institutional programmes - i. nutritional programmes and ii. humanitarian programmes. The nutritional programmes group needs nutrient-rich improved varieties (e.g., orange-fleshed varieties) to address nutritional security of children and women. Whereas humanitarian programmes need improved varieties that can address not only nutritional security but also climatic shocks and food security.
- Similarly, the needs of sweetpotato root producers have been further segmented based on the group of farmers who face specific challenges and needs, such as i. who do not have resources (i.e., irrigation or lives in dry areas) to conserve and multiply planting materials; ii. who live in high virus-pressure zone facing the risk of disease spread, and iii. Do not have access to sufficient and affordable materials at the time of planting and are looking for new varieties.
- Based on qualitative assessment, the study identifies the preferred traits of root producers who are connected to the domestic root market. These traits

1. We use the term "seed", "planting materials", "vine", and "cuttings" interchangeably.

include high root and vine yield, disease resistance, drought tolerance, desirable shape and size, smooth skin, shorter cooking time, and good storability. Based on the preferred traits identified across market segments, improved sweetpotato varieties have been identified to replace local landrace varieties that currently dominate the market. These include Tanzania and NAROSPOT 1 in Uganda, and UKG 05, Kabode, Ukerewe, and Polista varieties in Tanzania have been identified as suitable replacements that could increase the replacement rate among root producers.

- In Tanzania and Uganda, approximately 50 commercial seed producers (CSP) were trained in agronomy, certification procedures, and business skills. As a result, 44 CSPs in Tanzania and 6 in Uganda have been registered with the regulatory bodies, which will expand business opportunities for certified and Quality Declared Seed (QDS).
- Financially viable business models were developed, tested, and validated for trading certified sweetpotato seed by the sweetpotato CSPs based on four-step approach using the business model canvas – create, deliver, capture, and defend the value of the product.
- There are two financially viable business models for multiplying certified sweetpotato seed. The first method involves purchasing a minimum quantity of Early Generation Seed (EGS) from either National Agricultural Research Institutions or private TC labs based on a seed multiplication production calendar, conserving the EGS in a mini-screenhouse, and then multiplying certified seed in the open field each season. Using this model, CSPs are able to generate a profit margin of 77% to 85% based on the current market price in 2022, depending on the seed class. The second method involves CSPs sourcing EGS each season from another CSP within their community, without owning a mini-screenhouse and multiplying seed in the open field. With this method, CSPs are able to generate a profit margin of at least 76% to 85%, based on the market situation. Additionally, the vine waste from the sweetpotato seed production can be used to produce silage, which can generate additional revenue as demand for silage increases over time. Both business models have the potential to generate a minimum profit margin of 76% for both Certified 1 (C1) and Certified 2 (C2) seed classes.
- Value propositions (e.g., certified seed with quality assurance, discounted/competitive price, and extension support) were identified for a specific customer segment to trade certified sweetpotato seed by the trained sweetpotato CSPs.
- More than ten innovative seed marketing strategies (Reflective jackets, demo plots, radio adverts, signposts, agricultural and trade exhibitions, village and farmers' meetings and seasonal markets, visiting cards, and brochures) were developed, selected and implemented based on market and customer segments through a competitive Challenge Fund.

What was the problem?

More than 90 percent of sweetpotato producers in Uganda and Tanzania use farm-saved seeds or seeds from neighbouring farmers for root production. However, these varieties and seeds are of unknown provenance and health status, and root yields are low. To boost productivity, it is essential that technically and financially viable seed businesses provide improved varieties and clean seeds to farmers. Recent results have shown that farmers in areas with a long dry season in Uganda and Tanzania are willing to pay a premium for seed based on seed health attributes. This creates the potential for strengthening profitable sweetpotato seed businesses if seed producers are able to offer varieties and seed products that satisfy customer expectations, i.e., varieties with preferred traits, quality assured and affordable seed with points of sale easily accessible and with timely availability. Between 2020 and 2023, the financially viable sweetpotato seed business models have been developed and validated in Uganda and Tanzania. These models provide strong evidence for encouraging trained commercial seed producers (CSPs) to invest in trading certified sweetpotato seed.

What objectives did we set to achieve?

The sweetpotato seed business has struggled to attract seed entrepreneurs due to the lack of profitable business models that incorporate a combination of revenue streams and concise value proposition strategies. This has resulted in an unattractive business environment for potential investors. To address this issue, it is essential to identify and validate potential business models for marketing certified sweetpotato seed in Uganda and Tanzania, which can attract more investment and support the growth of the industry.

Where did we work?

We worked in the major sweetpotato producing regions of Uganda (Kamuli and Buyende districts in the Eastern Region) and Tanzania (Geita, Simiyu, Shinyanga, Kagera, Mwanza, Mara, and Tabora Regions).

What did we achieve?

Based on the findings of a rapid seed systems assessment, we engaged with the existing seed producers to develop a financially viable business model for specific customer segments. During this process, we designed interventions to address bottlenecks and support sweetpotato seed producers in developing and implementing sustainable business models. These interventions were presented using the business model canvas (BMC) framework developed by Osterwalder in 2005, which includes nine building blocks (as shown in Table 1). These blocks are divided into the four key steps of creating, delivering, capturing, and defending values in the development of a financially viable business model for commercial seed

producers (CSPs) to trade certified sweetpotato seed. Customer segments and value propositions are part of the value creation for specific customer segments. Delivery of the values can be carried out through distribution channels and customer relationship blocks. The values can be captured through revenue streams and key resource blocks. Finally, the values can be defended by implementing key activities, partnering with key stakeholders, and identifying economies of scale. While this BMC was developed to target a specific group of root producers, it can be adapted to address the needs of institutional buyers with slight adjustments across the nine blocks. The BMC is a dynamic document that is frequently revised in response to changing circumstances.

Table 1: Business Model Canvas for sweetpotato commercial seed producers in Uganda and Tanzania

Key Partners

Tanzania Agricultural Research Institute (TARI)

National Crop Resources Research Institute (NaCRRI)

Local government and national programmes

Seed Producers Association/ Cooperatives

Regulator bodies

Tissue culture laboratories

Research and development national and international organizations

Media - Radio, Newspapers agencies

Key Activities

Registration process for seed production with the regulatory bodies

Seed certification

Preparation of seed multiplication calendar and seed multiplication

Marketing activities - Branding through certification and logo creation; Reflective jackets, demo plots, radio adverts, signposts, agricultural and trade exhibitions

Key Resources

Mini-screenhouse, labels, sterilized soil; fertilizers

Irrigation materials

Land and Labour

Silage machine

Record books; customer feedback book, receipts note; customer database book; business cards

Disinfectant chemicals

Value Propositions

Improved varieties that were "best fits" to dominant market variety. These improved varieties have additional traits preferred by the root producers

Certified seed

Discounted and competitive price

Access to various released varieties and variety catalogue

Nutrient-rich (beta carotene rich orange-fleshed) varieties

Customer Relationships

Dedicated sweetpotato commercial seed producers (CSPs)

Discounted price for customers who order in advance

Customer feedback and after-sales services

Channels

Nudges (i.e., posters, radio shows, influential persons in the community)

National agricultural shows

Seasonal market and sales point

Sign boards in strategic locations with contact information

Online platforms (WhatsApp)

Demo plots and field days

Farmers'/Community meetings

Customer Segments

Institutional buyers

NGOs

Schools

International research and developmental organisations

Humanitarian organisations

Government institutions

Exporters

Sweetpotato root producers

Who do not have resources (i.e., irrigation or live in dry areas) to conserve and multiply planting materials

Who live in high virus-pressure areas facing yield decline from seed degeneration.

Who would like to try new varieties which have additional preferred traits for a specific root market segment.

Livestock keepers in need of dry-season fodder

Cost Structure (Uganda case)

The cost of production for certified seed varies from US$ 0.74 to US$ 0.87 per bag of 1000 cuttings of 30 cm size

Profit margin can be more than 75%

Certified seed price ranges between US$ 4 to US$ 5 per bag of 1000 cuttings of 30 cm size

The cost of basic/pre-basic seed is US$ 0.002 per cutting of 15 cm. The market price from the private tissue culture laboratory is US$ 0.024 per cutting of 15 cm.

CSPs highly recommended not to sell basic seed

Revenue Streams

Sale of different seed classes

Discounted price if customer orders in advance

Sale of silage

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Building block 1: Customer Segments

The creation of value for the sweetpotato seed business required the development of an affordable product that met the needs of customers and the market. CSPs were trained to identify different market segment based on challenges and needs faced by various types of customers. The potential market segments for improved varieties were identified as institutional buyers, sweetpotato root producers, and commercial seed producers. Currently, the main market segment is institutional buyers (around 85 percent of improved varieties are traded with institutional buyers). However, depending on the challenges and needs faced by root producers, the market share of improved seed will vary in the future.

Root producers are divided into three sub-segments based on their specific challenges and needs:

- Root producers who lack access to suitable land and water to preserve their planting materials
- Root producers who live in areas with high sweetpotato virus pressure
- Root producers who lack access to sufficient and affordable materials at the time of planting and are seeking new varieties.

Building block 2: Value proposition

The value propositions identified are intended to address the challenges faced by sub-segments of root producers. These value propositions consist of:

1. Improved varieties that best fit the dominant market preferences of root producers facing challenges and needs. This includes Tanzania and NAROSPOT 1 in Uganda, as well as UKG 05, Kabode, Ukerewe, and Polista in Tanzania, which have been identified as the best-fit varieties.
2. Quality assurance through certification of high-quality and improved planting materials. In addition, the seed producers are officially registered with the regulator.
3. Competitive and affordable pricing for certified planting materials, achieved through the use of cost-effective technologies and Good Agricultural Practices (GAPs) for Early Generation Seed (EGS) production.
4. Guaranteed availability of seed at the right time, by advance order system
5. Extension support on GAPs and easy access to more improved varieties through a variety catalogue.

Building block 3: Distribution channels

Delivering value in the seed business means defining the distribution channels/handover point through which the customer accesses the product. The process of identifying potential CSPs started by interviewing the root traders in the principal district markets to find out the dominant preferred sweetpotato varieties. We then traced back along the value chain to the farmers from whom the traders sourced their roots and, in turn, from where those root producers sourced their seed. It turned out that the major commercial root producers used their own saved planting material but also sold planting material to other farmers. In this way, we identified existing seed producers who were already well-linked into root markets and well-known in their communities for selling seed. Approximately 50 commercial seed producers (CSP) in Uganda and Tanzania received training in agronomy, certification procedures, and business skills. As a result, 44 CSPs in Tanzania and 7 in Uganda have been registered with the regulatory bodies,

Seven registered CSPs in Uganda with MAAIF's seed inspector. (Credit: S. Rajendran)

which will expand business opportunities for certified and Quality Declared seed (QDS).

Through collaboration with the local government structures in Tanzania and Uganda, all CSPs have formed seed producer cooperatives or associations. Busoga commercial seed producers and marketing cooperative (BUSECO) and "CHAWAVITA MB KAZI[2]" were formed in Uganda and Tanzania, respectively.

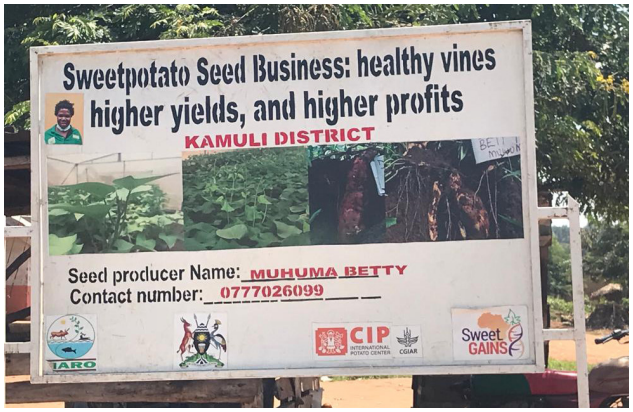
Registration certificate for the seed producers cooperative in Uganda and Tanzania (Credit: S. Rajendran)

This has strengthened the seed delivery system by connecting the upstream and downstream components of the sweetpotato seed value chain.

2. Association of producers and sellers of sweetpotato seed and products of sweetpotato in the Lake zone

Finally, the CSPs will reach their customer segments through the following distribution channels:

i. Farmers' participation in national agricultural shows
ii. Demo plots and field days
iii. Farmers'/Community meetings
iv. Online platforms (WhatsApp)
v. Seasonal/weekly markets and sales points in dedicated locations where there is a high virus-pressure areas
vi. Exclusive sign boards in a strategic location with contact information



Sign board (Credit: S. Rajendran)

Exclusive sales point (Credit: S. Rajendran)

Building block 4: Customer relationship

Retaining the customers in the seed business is a key, particularly for vegetatively propagated crops. Therefore, it is important to strengthen the relationship to create loyal customers and retain them in the seed business. The following activities carried out:

i. Established dedicated sweetpotato commercial seed producers (CSPs) in strategic locations
ii. Discounted price for customers who order in advance
iii. Customer feedback and after-sales services

The EGS producers and CSPs have developed feedback systems by gathering customer feedback through phone and WhatsApp communities to build relationship and retain customers for the long term. For instance, TARI sells basic seed to CSPs and provide them with feedback, which is filled and returned by CSPs. Also, CSPs provide contacts to their customers to enhance communication, such as feedback and after-sales services (i.e., GAP). Though we have introduced the branding concept, it requires positioning the brand among consumers and strengthening the communication strategies will engage customers with CSPs continuously.

Good Agricultural Practice (GAPs) training in the field (Credit: S. Rajendran)

Building block 5: Revenue stream

CSPs generate revenue through direct sales of different seed classes to root producers through various distribution channels.

The value of the sweetpotato seed business is captured by understanding and ensuring the financial viability of the seed business models. In formal and semi-formal seed businesses in Uganda and Tanzania, different sweetpotato seed classes are traded in accordance with national Seed Acts and Regulations (Figure 2). Tanzania follows the OECD system with breeder seed, pre-basic, basic, certified seed classes, and a category for quality declared seed (QDS). In Uganda, the seed classes are breeder seed/nuclear stock, basic/foundation seed, certified 1 seed, certified 2 seed, and QDS.

The breeder material is normally controlled by the plant breeders or institutions who developed the variety. Once the variety is cleaned and indexed, it will be kept in the laboratory for at least 4 to 5 years. The second category of seed is EGS which is produced in a controlled environment such as the screenhouse. It includes stages 1 to 3 in the seed value chain, where planting materials move from laboratories to Screenhouses (Figure 2). There are a few big players (both public and private tissue culture laboratories) involved in the EGS business, which they address the needs of different customer segments. The next stage is the Certified seed class (i.e., stages 4 and 5). It is generally produced in the open field using rapid multiplication techniques (RMT) for mass multiplication of the seed. However, to have a consistent supply of certified seed, some seed producers conserve EGS planting materials in the mini-screenhouse. Finally, it should be noted that in Tanzania and Uganda, the QDS seed class is based on the level of seed quality assurance set by seed regulators.

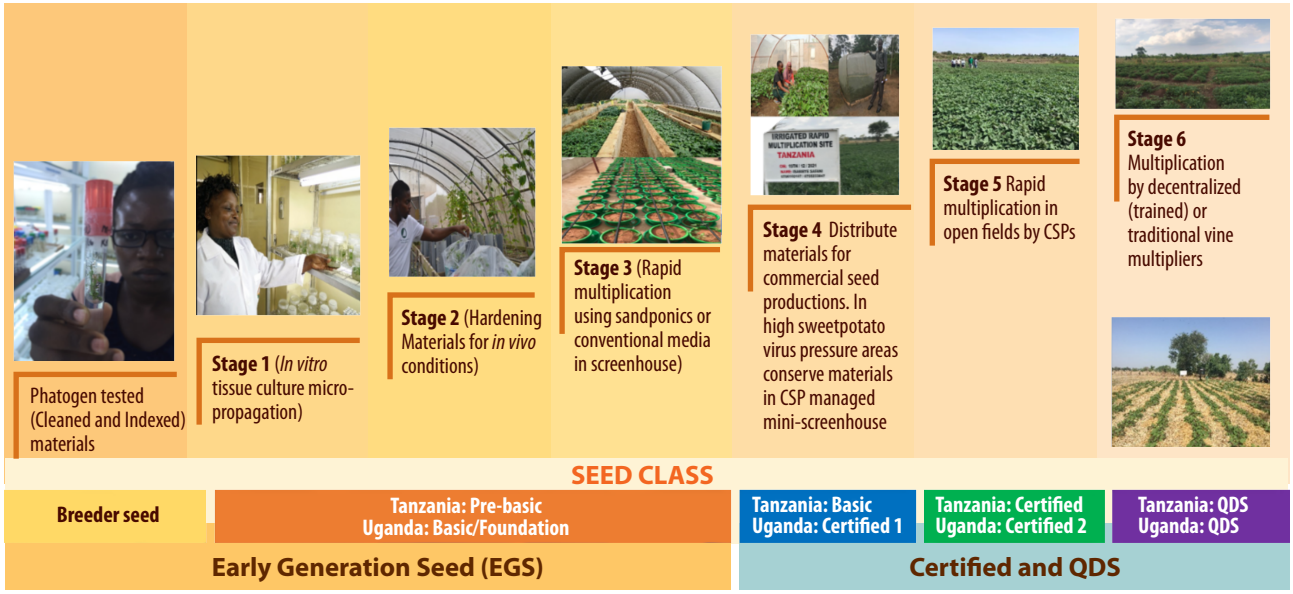


Figure 2: Sweetpotato seed value chain and seed classes in Tanzania and Uganda

The Sweetpotato Genetic Advances and Innovative Seed Systems (SweetGAINS) project team, potential value chain linkages across the formal, semi-formal, and informal seed systems were identified. A sweetpotato seed entrepreneur can participate at any stage of the seed value chain and produce any type of seed class if they are compliant under their national seed legislation. However, the CSPs normally enter at stage 4 and exit in the same stage or stage 5 and/or 6 after which the linkage is to the informal seed sector. Since the majority of root producers are sourcing their seed from the informal sector, it is important for the formal and semi-formal seed producers to connect with the informal sector. This will ensure that the informal seed producers have access to improved varieties and quality seed to reach and supply the majority of seed users. By having improved varieties and improved quality of seed products, informal seed producers can also improve their business revenues.

Several business models were developed and tested with CSPs using demonstration plots and financial analysis. Two business models demonstrated a better profit margin in Uganda (Table 2a) and Tanzania (Table 2b). In the first business model, a CSP uses its own mini-screenhouse to conserve its starter stock sourced from pathogen-tested EGS, and then uses rapid multiplication technology in open fields for large-scale production of certified seed. This earns a higher profit margin (77-85%) compared to the other business models

In the second business model, CSPs source certified seed (C1) from a CSP who owns mini-screenhouse to produce second-generation certified seed (C2). The estimated profit margin for the second business model varies between 76-83%.

Both business models produce a profit margin greater than 75%. Moreover, in Uganda, if there are excess vines, these can be processed for silage for livestock to increase the profit margin by over 80%.

Both business models can sell certified seed (i.e., a premium product) at an affordable price. Further, the profit margin and price differ by seed class and market situation. CSPs able to sell C1 seed higher price than C2 seed due to quality differences.

A commercial seed producers owns mini-screenhouse and applies the first business model (Credit: S. Rajendran)

Mini screenhouse owned by a CSP in Uganda (Credit: S. Rajendran)

Rapid seed multiplication by a CSP in Uganda (Credit: S. Rajendran)

Table 2a: Financial viability of sweetpotato seed business models in Uganda

Production method	Seed class	Unit name	Cost per unit (break-even cost)	Profit margin	Average market price per sales unit (Competitor price)	Average own price per sales unit
CSP with mini-screenhouse	Basic seed	15 cm cuttings	US$ 0.002		US$ 0.024	
If basic seed sourced from Senai Farms Ltd (EGS producer)	C1 seed	Bag (1000 cuttings of 30 cm)	US$ 1.64	59%	US$ 10.53	US$3.95
If basic sourced from own mini-screenhouse	C1 seed	Bag (1000 cutting of 30 cm)	US$ 0.74	81%	US$ 10.53	US$3.95
If C1 sourced from own source	C2 seed	Bag (1000 cutting of 30 cm)	US$ 0.80	85%	US$ 5.25	US$5.25
CSP without mini-sreenhouse	C2 seed	Bag (1000 cutting of 30 cm)	US$ 0.87	83%	US$ 5.25	US$5.25

Table 2b: Potential business models for sweetpotato seed business and its financial viability in Tanzania

Business Model	Seed class (30cm cuttings)	Net income (1000 sqm)	Cost per 30 cm cuttings (break-even cost)	Profit Margin
Without mini-screenhouse (One multiplication cycle)	C1	US$ 2,522.3	US$ 0.0047	64%
Without mini-screenhouse (Two multiplication cycles)	C2	US$ 3,211.6	US$ 0.0034	76%
With mini-screenhouse	Basic	US$ 2312.6	US$ 0.0051	59%
With mini-screenhouse (Two multiplication cycles)	C1	US$ 3,024.6	US$ 0.0030	77%

Although BMC was developed for a specific customer and market segment, CSPs are encouraged to maximize their current resources by separating seed and root production plots and utilizing good agricultural practices (GAPs) for higher seed and root yields of the best-fit varieties with market-preferred attributes. This will enhance the overall revenue stream of sweetpotato seed and root business enterprise.

Building block 6: Key resources

It is important to generate resources internally to deliver the value proposition. One of the key resources for CSPs is a mini-screenhouse to conserve basic seed in the screenhouse to have a consistent supply of basic seed when it is required at an affordable cost. The mini-screenhouse was constructed through a co-investment package. The cost of the mini-screenhouse is about USD 860, in which CSPs contributed in-kind through the provision of land and labour. Also, CSPs contributed about 18% of the cost of irrigation equipment, which was about USD 350. Further, CSPs invested in the construction of water reservoirs to enhance availability of water in the off season. In addition, some CSPs have invested in silage machines for silage production. To further enhance their business operations, CSPs have taken steps such as printing business cards to connect with potential customers. Additionally, CSPs have invested in feedback and receipt books for sales, customer database books for collecting customer information, and customer registration books.

Building block 7: Key activities

One of the main activities is to be registered as a sweetpotato commercial seed producer with regulatory body. Once the seed producers register as a commercial seed producer, the seed producers need to prepare the seed multiplication calendar based on the seed requirements of root producers for the coming season. After production, the planting material must be certified with the regulatory body to sell seed as "certified seed." Branding and marketing of the certified seed is key to reaching out potential customer segments and retaining them in the seed business. Currently, the CSPs are engaged in branding their planting materials through the introduction of certified planting materials that are labeled with the variety name and its unique characteristics. They also participated actively in national agricultural shows, radio shows, and farmers' field days to position the product among root producers.

Field day in Uganda (Credit: S. Rajendran)

CSP explains GAP for producing quality seed and its benefits (Credit: S. Rajendran)

Building block 8: Key partners

CIP partnered with TARI and NaCRRI through the Sweetpotato Genetic Advances and Innovative Seed Systems (SweetGAINS) project to train and provide technical backstopping to the seed producers on quality seed production practices, business planning and marketing of sweetpotato seeds. This training culminated in the regulatory body registering the successful participants as certified seed producers.

Also, the cooperative/association has ensured that members can easily access business opportunities for roots and seeds by partnering with the public and private sectors. As part of the process, the cooperative and association established an official business partnership with EGS producers (i.e., NaCRRI in Uganda and TARI in Tanzania) through a Memorandum of Understanding (MoU). This partnership enables them to access high-quality EGS at affordable prices. The cooperative/association has established initial discussions with other potential partners in the sweetpotato value chain to explore opportunities for expanding their business.

In addition, the cooperative and the association have established a close relationship with local government programs (e.g., the Parish Development Model in Uganda), local government departments, NGOs (e.g., VEDCO), international organizations (e.g., World Vision, WFP, Harvest Plus) to attract more institutional buyers. Further, the association/cooperative has identified processors as a potential market segment for CSPs. However, the value proposition at the association/ cooperative level needs to be refined as per specific customer profile and market segment. In the future, the customer profile will be analyzed in greater detail through psychographic and demographic segmentation to gain a deeper understanding of customer behavior.

Building block 9: Cost structure

An affordable price of seed for root producers depends on the costs of seed production at each stage through the seed supply chain. Moreover, each type of seed production enterprise needs to be profitable. Tanzania Agricultural Research Institute (TARI) introduced sandponics technology for cost-effective screenhouse production of pre-basic seed. This has been shown to reduce the unit cost of EGS production by 21%. Timely supply of starter seed was ensured by advance orders made by CSPs through their seed producer association or cooperative and partnership with National Agricultural Research Institutions (NARIs). The CSPs used their training in good agricultural practices, particularly on rapid seed multiplication, to improve productivity – increasing vine yields by 10 times more than existing farmer practices. This provides an option for seed producers to sell their quality seed at an affordable and competitive price while improving their profit margin by 76 to 86% based on demand.

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Were there any key challenges or lessons learned?

- Explore more market segments and customer profiles to understand the demand for quality planting materials and identify value propositions.
- Access to credit will be critical as CSPs grow the scale of their operations. Credit provision would enable advance orders (and payment) for EGS. The seed producer association and cooperative could broker these arrangements for their members.
- There is a significant gap between actual and potential seed requirement due to lack of historical time series data for key indicators by such as adoption rate, seed replacement rate, repurchase rate, variety turnover rate, and effective demand for various seed classes. Therefore, these indicators need to be validated through an expert elicitation approach and extensive primary surveys.
- Although CSPs possess basic financial and technical skills, there is a need to introduce user-friendly digital interventions for record-keeping purposes.
- The certification process needs to be made simpler and more cost-effective.

Next Steps

- The business canvas model requires continuous refinement by CSPs based on their experience and the changing business environment.
- Identify strategies to expand CSPs' adoption of validated sweetpotato seed business models in other ecological and market conditions.

  It is necessary for CSPs to have better planning in agronomic practices and decision-making in seed business management. So that CSPs can optimise their resource allocation efficiently. Therefore, CSPs require assistance in planning and decision-making for resource allocation in sweetpotato seed business management. There will be a plan to introduce user-friendly digital planning and business investment decision tool for the public and small to medium scale sweetpotato seed entrepreneurs. This tool also empowers CSPs to develop or revise their business plan, which can then be utilized to secure credit from financial institutions and fortify their seed business.

Partners

- NaCRRI, Uganda
- Tanzania Agricultural Research Institute (TARI)
- VEDCO, Uganda
- SENAI, Uganda
- TAHEA , Tanzania
- Busoga commercial seed producers and marketing cooperative (BUSECO), Uganda
- Chama cha Wazalishaji na Wauzaji wa Mbegu Bora na Mazao ya Viazi Vitamu Kanda ya Ziwa (CHAWAVITA MB KAZI), Tanzania (In English - Association of producers and sellers of sweetpotato seed and products of sweetpotato in the Lake zone (CHAWAVITA MB KAZI)

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